

04-707

MEMORANDUM OF UNDERSTANDING BETWEEN
THE UNITED STATES NATIONAL AERONAUTICS
AND SPACE ADMINISTRATION
AND
THE DEUTSCHE AGENTUR FÜR RAUMFAHRTANGELEGENHEITEN
SUPPLEMENTING AND AMENDING THE
MEMORANDUM OF UNDERSTANDING OF OCTOBER 6, 1987,
FOR COOPERATIVE FLIGHTS OF THE SPACEBORNE IMAGING RADAR (SIR)
WITH THE X-BAND SYNTHETIC APERTURE RADAR (X-SAR)

The United States National Aeronautics and Space Administration (NASA) and the Deutsche Agentur für Raumfahrtangelegenheiten (DARA),

Having cooperated pursuant to the Memorandum of Understanding for Cooperative Flights of the Spaceborne Imaging Radar (SIR) with the X-Band Synthetic Aperture Radar (X-SAR), signed at Bonn October 6, 1987 (the 1987 MOU), as amended by the exchange of letters of February 18 and March 25, 1994;

Noting that the 1994 amendment, *inter alia*, established DARA as the successor to the Federal Minister of Research and Technology of the Federal Republic of Germany in the implementation of the 1987 MOU;

Having decided to fly the X-SAR instrument for a third time on the Space Shuttle as part of the Shuttle Radar Topography Mission (SRTM); and,

Recognizing the need to supplement and amend the 1987 MOU to reflect the integration of the cooperation within the framework of SRTM;

HAVE AGREED AS FOLLOWS:

Article 1 - Purpose

NASA and DARA desire to extend their fruitful cooperation in the first two SIR-C/X-SAR missions in 1994, and in accordance with Article 2(1) of the 1987 MOU will add an X-SAR instrument flight on the Space Shuttle as part of the SRTM. SRTM will consist of the modified SIR-C and X-SAR instruments. Its primary objective will be to measure the topographic surface of the Earth. All provisions of the 1987 MOU shall remain in effect *mutatis mutandis* for SRTM unless modified by this MOU.

Article 2 - SRTM Description

For SRTM, the SIR-C and X-SAR instruments will each be modified with an additional antenna to be attached to a boom, and electronics hardware, to operate as interferometers. The SIR-C instrument will be capable of collecting near-global, contiguous SAR and Interferometric SAR (IFSAR) data covering all land areas between approximately 60° north and 54° south latitude which will be processed to generate terrain height data with approximately 16 meter absolute vertical accuracy at 1 second of arc latitude and longitude. The X-SAR Interferometer will provide non-contiguous data with approximately 12 meter absolute vertical accuracy.

Article 3 - Scientific and Technical Objectives of SRTM

The prime objective of SRTM is to provide the following Interferometric Terrain Height Data (ITHD) for all land areas between approximately 60° north and 54° south latitude:

- near-global, contiguous ITHD with 3 seconds of arc latitude and longitude (ITHD-1)
- near-global, contiguous ITHD with 1 second of arc latitude and longitude (ITHD-2)
- non-contiguous ITHD in up to 50 km wide swathes with 1 second of arc latitude and longitude (ITHD-2), with higher vertical accuracy

The geoscientific investigations of the first two SIR-C/X-SAR missions shall continue to be another important objective, based mainly on the C- and X-band imagery obtained.

The technical objectives of SRTM are to develop and demonstrate the capability (1) of obtaining single-pass interferometric SAR-data in C- and X-Band and (2) to process these data into ITHD on a global scale.

ITHD shall be made available for improved interpretation of the data for the test sites from the first two SIR-C/X-SAR missions, consistent with data guidelines to be developed by and jointly agreed by NASA and the U.S. National Imagery and Mapping Agency (NIMA).

Article 4 - Participation

To implement SRTM, NASA will cooperate with other U.S. Government agencies and with DARA. On the German side, due to positive results obtained by the first two SIR-C/X-SAR missions, the successful cooperation between DARA, the Deutsche Forschungsanstalt für Luft und Raumfahrt (DLR) and the Agenzia Spaziale Italiana (ASI) will be continued. In order to guarantee a clear functional interface with NASA, DARA will act as the lead agency for the German-Italian cooperation and will represent the interests and the responsibilities of DLR and ASI to NASA for SRTM. NASA will coordinate with other U.S. Government agencies and ensure that their interests and responsibilities are properly represented for SRTM.

Article 5 - Responsibilities of NASA

For the SRTM mission NASA will use reasonable efforts to fulfill the following responsibilities:

1. Provide the existing SIR-C hardware in functional condition, as well as any infrastructure necessary for a reflight of such;
2. Coordinate the design of the SRTM system with DARA, secure or fabricate the necessary additional components, and modify the existing SIR-C hardware and software to operate as an interferometer;
3. Integrate X-SAR with the SIR-C system to create the SRTM interferometer;
4. Integrate and test the SRTM system and prepare for launching by the Space Shuttle;
5. Design and implement necessary ground systems for mission operations, SAR and IFSAR data processing, and generating the registered C-Band scansar digital elevation model (DEM) data sets;
6. Launch the SRTM system in late Fiscal Year 2000 or earlier on the Space Shuttle as defined in the SRTM Implementation Plan;
7. Provide the following from SIR-C to DARA: image data and ITHD-1 data worldwide; ITHD-2 data over the U.S.; and, in accordance with guidelines to be developed by and jointly agreed by NASA and NIMA, other ITHD-2 data as requested to support jointly agreed scientific investigations and for governmental use;
8. Operate together with DARA the SRTM system, acquire, calibrate and process the SIR-C SAR and IFSAR data for each ascending and descending pass over land areas, and generate a strip of DEM data sets in accordance with the schedule defined in the SRTM Implementation Plan;
9. Provide the C-Band SAR data from ascending and descending orbits processed into orthorectified image strips that can be made into a global map;
10. Provide all X-SAR data to DARA as soon as practicable after the end of the mission, including the best available Shuttle Orbit, Shuttle Attitude and boom metrology data; and
11. Provide access to available topographic reference data to support verification of SRTM terrain height data during processing.

Article 6 - Responsibilities of DARA

For the SRTM mission DARA will use reasonable efforts to fulfill the following responsibilities:

- I. Modify the existing letter agreement between DARA and ASI to take into account the specific roles and responsibilities as applicable to SRTM;

2. Establish an agreement between DARA and DLR which defines the DLR contributions to SRTM;
3. Coordinate with NASA in designing the SRTM system, secure or fabricate the necessary additional X-SAR components, and modify existing X-SAR hardware and software to operate as an interferometer;
4. Provide support to NASA for integrating the X-SAR with the SIR-C system to create the SRTM interferometer, and provide support for integration of SRTM with the Space Shuttle;
5. Design and implement necessary ground systems for mission operations, SAR and IFSAR data processing, and generating the registered X-band DEM data sets;
6. Provide the following from X-SAR to NASA: image data worldwide; ITHD-2 data over Germany; other ITHD-2 data as requested to support jointly agreed scientific investigations and for governmental use; and other data sets as jointly agreed by DARA and NASA;
7. Provide support and make available X-SAR data to NASA to improve, validate and verify the ITHD C-band data sets;
8. If requested and confirmed in a separate agreement to be concluded in due time, provide the capability to process an amount to be determined of SIR-C interferometric data to ITHD-2 and to generate mosaicked SIR-C/X-SAR data as a contribution to the ITHD data sets; and
9. Provide access to available topographic reference data to support verification of SRTM terrain height data during processing.

Article 7 - Science Data Rights

For SRTM the following data provisions will apply:

1. It is the intent of the Parties that no data from SRTM will be classified.
2. Designated investigators will not have a period of exclusive data use.
3. In the event that users who are supported by either NASA or DARA or the entities they represent generate copyrighted reports or publications resulting from SRTM, NASA and DARA and the entities they represent shall have a royalty-free right under the copyright to reproduce, distribute and use such copyrighted work for their own purposes.

4. All X-SAR data generated during the mission is the property of DARA and ASI.
5. NASA will distribute raw (amplitude) and processed image data obtained from SIR-C. The data will be archived in the appropriate NASA data center and made available to all users without restriction and at no more than the cost of fulfilling the user request.
6. DARA and the entities they represent will each distribute its raw (amplitude) and processed image data obtained from X-SAR. The data will accordingly be archived in the appropriate processing and archiving facilities and made available to all users without restriction and at no more than the cost of fulfilling the user request.
7. NASA and DARA may use their respective DEMs for merging both data sets to a combined, improved product.
8. NASA will consult with DARA on the content of the data guidelines to be developed by NASA and NIMA with respect to their impact on the implementation of this MOU.
9. Once the data guidelines developed by NASA and NIMA have been completed, NASA and DARA may expand the data to be exchanged between them, in accordance with the guidelines.
10. Access to data currently held by NIMA will be negotiated through NIMA's German counterpart.

Article 8 - Transfer of Technical Data and Goods

The Parties are obligated to transfer only those technical data and goods necessary to fulfill their respective responsibilities under this amendment, in accordance with the following provisions:

1. Interface, integration, and safety data (excluding detailed design, development, production, and manufacturing data, and associated software) shall be exchanged by the Parties without restriction as to use or disclosure, except as specifically required by national laws and regulations.
2. In the event a Party finds it necessary to transfer technical data or goods other than those specified in paragraph 1 of this Article in carrying out its responsibilities under this amendment, the provisions of this paragraph shall apply. In transferring data and goods which are proprietary or subject to export controls, and for which protection is to be maintained, such technical data shall be marked with a notice and such goods shall be specially identified to indicate that they shall be used and disclosed by the receiving Party, entities acting on its behalf, and its contractors and subcontractors only for the purposes of fulfilling the receiving Party's responsibilities under this amendment, and that

the marked technical data and identified goods shall not be disclosed or retransferred to any other entity without prior written permission of the furnishing Party. The receiving Party agrees to abide by the terms of the notice, and to protect any such marked technical data or identified goods from unauthorized use and disclosure. Nothing in this Article requires the Parties to transfer technical data or goods contrary to national laws and regulations relating to export control or control of classified data.

3. The Parties are under no obligation to protect any unmarked technical data or unidentified goods. However, all technical data and goods transferred under this amendment shall be used exclusively for the purposes of fulfilling the Parties' responsibilities under this amendment.

Article 9 - Patent and Invention Rights

Nothing in this MOU shall be construed as granting or implying any rights to, or interest in, patents or inventions of the parties or their contractors or subcontractors.

Article 10 - Liability

Paragraphs 3 and 4 of Article 14 of the 1987 MOU are hereby deleted.

Article 11 - Entry into Force and Termination

This MOU will enter into force upon signature. It may be terminated by either Party upon one year's written notice.

Article 12 - Duration

Subject to the provisions of Article 19 of the 1987 MOU and Article 11 of the present MOU regarding termination, the 1987 MOU and this MOU will remain in force for a period of five years from the date of entry into force of this MOU, at which time they will terminate unless extended by mutual written agreement of the Parties.

Done at [Washington]

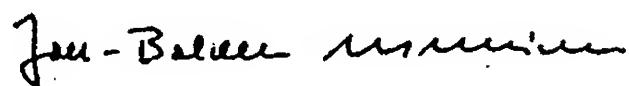
on September 30th, 1997, in duplicate,



FOR THE UNITED STATES
NATIONAL AERONAUTICS AND
SPACE ADMINISTRATION

Done at Bonn

on September 26th, 1997, in duplicate,



FOR THE DEUTSCHE AGENTUR FUR
RAUMFAHRTANGELEGENHEITEN